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ABSTRACT

The field of early childhood education has long been marked by intense controversy concerning appropriate curriculum and teaching methods and goals. This paper explores some implications of the traditional dichotomies of the field and suggests that while there are many reasons to resist the side that advocates formal academic instruction, it does not necessarily follow that what is offered to children in non-academic programs sufficiently addresses their intellectual development. In particular, it is asserted that common confusion between academic and intellectual goals often leads to the neglect of the basic intellectual dispositions of young children, all of which must be strengthened and supported in the early years. An example of a project conducted with young children that addresses all the major goals of early education is appended. (Contains 33 references.) (Author/KB)

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Balancing Constructivist and Instructivist Curriculum Goals in Early Childhood Education

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Abstract

The field of early childhood education has long been marked by intense controversy concerning appropriate curriculum and teaching methods and goals. This article explores some implications of the traditional dichotomies of the field and suggests that while there are many reasons to resist the side that advocates formal academic instruction, it does not necessarily follow that what is offered to children in non-academic programs sufficiently addresses their intellectual development. In particular, it is asserted that common confusion between academic and intellectual goals often leads to the neglect of the basic intellectual dispositions of young children, all of which must be strengthened and supported in the early years. An example of a project conducted with young children that addresses all the major goals of early education is appended.

Balancing Constructivist and Instructivist Curriculum Goals in Early Childhood Education

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Dissention concerning curriculum and teaching methods has been a feature of the field of early childhood education from its beginnings. In recent times Roopnarine and Johnson (1993) have noted that early childhood education is "a profession teeming with controversy, impassioned with deeply held convictions, and inspired by rival value systems" (p. iii).

The persistent polarization concerning curriculum and teaching methods is related to many factors. Among them are ideological positions--usually referred to as philosophies, competing theories of development and learning, and conflicting pressures from various stakeholders concerning the desired outcomes of early childhood education.

The issues involved have been expressed in various ways. Some are stated in terms of the aims and goals of the programs, e.g. academic learning versus personal-social development, teacher-centered versus child-centered (See Stipek, 1993). Some define the issues in terms of the respective roles of the teacher and the children, e.g. teacher-directed versus child-initiated (Marcon, 1992, 1995). Others express them in terms of the content and nature of the activities offered, e.g. Hirsch (1996a & 1996b) (See also Goffin, 1994).

Contemporary exchanges on these long-standing issues tend to be cast in the language of *constructivism* or socio-constructivism, emphasizing children's active construction of knowledge in contrast to children's passive reception of instruction offered to them by adults.

The purpose of this article is to explore some implications of the traditional polarization referred to above, and to suggest possible alternative views. In particular, I suggest that neither of the two competing positions sufficiently addresses the importance of supporting children's *intellectual* versus academic development. That is to say that just because young children are not engaged in drill and practice of academic exercises *does not mean that what they are doing sufficiently supports their intellectual development.*

Dichotomizing Curriculum and Teaching Methods and Goals

Current use of the term *constructivism* as a rationale underlying curriculum and teaching methods suggests that dissension in the field can be dichotomized as two competing views on how children best learn and on desirable goals. On the one side the young child is seen as an active constructor of knowledge and understandings; a major goal of a constructivist curriculum then is to provide ample opportunity for active construction of knowledge. On the other side, they are seen as dependent on another's instruction in the important knowledge and skills that will launch them onto a good start for their later academic achievement (See Katz, 1996). This dichotomy captures the major disagreement in the field concerning the extent to which an early childhood curriculum and its associated teaching methods should offer children ample opportunity to actively explore their environments and engage in spontaneous play. On the constructivist side it is assumed that such child-initiated exploration, well "scaffolded" by adults, is the developmentally appropriate way to support their learning. By contrast, others favoring a large component of formal instruction in basic academic skills put children in a passive receptive role of internalizing the knowledge transmitted and systematic practice of the literacy and numeracy skills to be learned. These dichotomies are summarized in Table 1.

[Table 1 about here]

However, as we explore some of the implications of this traditional dichotomy in the field, and examine other ways to define the goals of early childhood education, it is useful to keep in mind that today most classes offer some mix or blend of these two positions.

Table 1. A summary of the common terms used to describe contrasting emphases in curriculum and teaching methods in early childhood education

Constructivist	**Instructivist**
Child initiated activities	Teacher initiated or teacher directed activities
Child-centered topics and activities	Teacher-centered or teacher-determined topics & activities
Play-based, "progressive" curriculum	Didactic or "traditional" school curriculum
Personal-social development goals	Basic academic skills mastery goals
Developmentally appropriate curriculum & methods	Developmentally inappropriate curriculum and methods
Progressive/child centered, encouraging children to construct their own knowledge	"Core Knowledge" systematically presented to children
Informal/Unstructured classroom organization	Formal/Structured classroom organization
Process oriented activities emphasized	Product oriented activities emphasized

More than half a century ago, Dorothy Gardner (1942) attempted to put to rest once and for all the similar raging controversy at that time about curriculum and teaching methods by conducting a comparative study of two nursery schools. School A was characterized by what would be called today 'developmentally appropriate practice' (DAP) emphasizing creativity and spontaneous play, and School B, characterized by formal teacher-directed activities, now commonly referred to as 'academic' in focus. Despite Gardner's findings in favor of School A, the debate over curriculum and methods resumed barely a generation later.

In the last twenty years similar empirical comparative studies have been reported (See for example Consortium for Longitudinal Studies, 1983; Schweinhart, 1994; 1997; Schweinhart & Weikart 1992; Marcon, 1992; 1995). The results of these studies have been somewhat mixed though generally close to Gardner's earlier findings to the effect that those children enrolled in preschools on the constructivist side of the dichotomy fare better in school *in the long run* - especially the boys (Miller & Bizzell, 1983; Marcon, 1992).

Developmentally Appropriate Practice

One of the most recent best known and concerted efforts to put the longstanding curriculum and methods

controversies to rest was the 1987 position taken by the National Association for the Education of Young Children's (NAEYC). The position statement, titled *Developmentally Appropriate Practice* (DAP for short), was well received, especially among practitioners. However, among scholars in the field it engendered still further debate and discussion, especially concerning cultural and ideological issues (see Spodek, 1988; Delpit, 1988, Jipson, 1991; Lubeck (1992), Fleer, (1995). In response to these critiques a revised edition of DAP was published in 1997 (Bredekamp and Copple). Expressed in terms of what was deemed *developmentally* appropriate (Bredekamp, 1987), the document, does not offer a curriculum or set of teaching methods. Its purpose is to take a position on the controversies surrounding early childhood practice by suggesting that the appropriateness of curricula and teaching methods for young children should be based on what is known about normative patterns of young children's development and individual variations within them.

The "both/and" position. Of special relevance to this discussion is that among the major revisions in the second edition of DAP is the attempt to eschew the dichotomous "either/or" polarized approach to curriculum and teaching methods in favor of a *"both/and"* approach. The document lists nine examples of ways that early childhood practices should incorporate both sides of the traditionally contrasting models or approaches (See Bredekamp and Copple,

1997, p. 23). However, as shown in the results of a study of contrasting curriculum models by Marcon, (1992; 1995), empirical studies surprisingly fail to demonstrate the benefits one would expect of the kind of "best of both worlds" curriculum strategy advocated by Bredekamp & Copple (1997). One would expect, as by Alexander, Murphy & Woods (1996), that a curriculum incorporating both the constructivist and instructivist goals and practices would yield the potential benefits of both of approaches, and would therefore out-perform either extreme. Why this potential advantage has not been shown is not clear.

The risks of polar positions. One of the major concerns about this historical squabbling over goals and methods is that polarizations or dichotomies may - albeit inadvertently - cause us to overlook third, fourth, or more other options besides the two in opposition. In other words it may be that both sides in the enduring struggle overlook curriculum and teaching methods beyond the traditional dichotomy. Years of experience of observing early childhood classrooms suggest to me that both sides under-emphasize and under-value a third option: namely, curriculum and teaching methods that address children's *intellectual* development as distinct from the instructivist emphasis on *academic* learning and the *anti-instructivist* emphasis on children's play and self-initiated learning. Though constructivist theory does not in any way urge adherents to neglect intellectual development, it seems often to be

interpreted to imply that since children "construct their own learning" adults have little more to do than set out a range of nice activities children generally enjoy while studiously avoiding formal instruction in basic academic skills.

Indeed, it is not surprising that those observers of non-academic preschool and kindergarten classes who have little knowledge of young children, (e.g. E. D. Hirsch, Jr.,) criticize "progressive" and "constructivist" classes as banal, vacuous, over-emphasizing play and fun, and wasteful of children's capacities. A fairly typical example of such a class is described below.

> Some years ago I visited an early childhood program specially provided for children of low income families. The program was in a region of our country best known for its dairy farming and dairy products. It just happened that the visit occurred in mid-March. On entry into the classroom for four-year-olds I noted that all were engaged in a task that involved them in pasting cotton balls onto a picture of a smiling lamb (with long eyelashes too!). It surprised me to think that there might be sheep farming in the area; but as it was the first week of spring, it seemed possible that the children would have been alerted to the sheep and been taken to see some lambs. Thus I asked one of the four-year-olds boys "Have you been to see some lambs?" When he said "No," I asked him "Well, why are you doing this then?" After a brief period of reflection he responded "Because lambs like to March."! Thus he made the best sense he could of the activity, having been told the previous day

that spring comes in like a lamb and goes out like a lion!

This is one example of many observed over the years in which young children are offered activities that, while not as mind-deadening as many academic exercises of discrete disembedded skills - also fail to be as intellectually challenging or mind-engaging as the constructivist position would recommend. Indeed, if E. D. Hirsch, Jr. identifies the kind of activities described above as "progressive" education we can perhaps begin to understand his advocacy of formal instruction in what he believes constitutes an essential "core" of cultural knowledge (Hirsch,1996b).

I begin this exploration of the issues by outlining the main distinctions between the intellectual and academic goals and activities and follow with a discussion of their implications.

Academic and intellectual goals and activities

Academic goals and activities

During a period of about twenty years the term *academic* has come to denote those parts of the early childhood curriculum intended to help children to master the basic skills involved in literacy and numeracy (Jacobsen, 1996). Several factors may account for increasing pressure in the US and elsewhere to launch children into mastery of

academic knowledge and skills (e.g. in literacy and numeracy) as early as the preschool and kindergarten years.

One factor is the increasing demand and widening expectation that preschool and kindergarten programs ensure children's readiness for the next school setting and the next grade. This "push down" phenomenon is a traditional tendency at every level of education to push down the expectations and curriculum from older to younger children. For example, today's high school economics was yesterday's college course, and today's middle school geography concepts were very likely taught in high school fifty years ago, and so forth.

In early childhood classes with a strong academic focus - an 'instructivist' approach - the teacher's role is that of expert and the role of the child is a passive and reactive, rather than the active and interactive one expected and assumed by the 'constructivist' approach. Doyle (1986) states that academic goals that are addressed by direct instruction "are defined by answers students are required to produce" (p. 177). They frequently involve memorizing lists or symbols, responding to questions that have correct answers, practicing routine tasks that can be specified and assessed as right or wrong, correct or incorrect.

Another consideration is that the traditional importance given to spontaneous play as the natural way that children learn may be a less convincing today; a half a century ago opportunities and artifacts for play,

especially in the home, were considerably less plentiful than today for the majority of children.

Academic Tasks. Academic tasks are typically carefully structured, sequenced and decontextualized small bits of information and discrete skills that often require some small group or individual instruction by a knowledgeable adult. They include also exercises designed to help achieve mastery of them. The academic tasks in the early childhood curriculum usually address facts and skills that the majority of children are unlikely to learn spontaneously or by discovery, though under favorable conditions, many children do so. For example, under the right environmental conditions, many young children can "pick up" the names of colors and shapes and need little in the way of didactic or systematic, formal instruction to learn them. As in the case of acquiring phonemic awareness, academic goals address items of knowledge that have to be memorized and rehearsed. These items of knowledge may be spontaneously "constructed" by some children, as can be seen in invented spelling; but in such cases they are largely mis-constructed and require assistance to re-construct correctly.

Similarly, the alphabet, an arbitrary sequence of symbols developed over a long period of human history, has no inherent discoverable logic. It has to be mastered with the help of knowledgeable others who encourage frequent repetition and who correct errors until mastery is

achieved. In the case of most young children, it would be wasteful and inefficient for them to have to "discover" such things as the alphabet, or punctuation rules, the pledge of allegiance, the national anthem or other conventional knowledge by self-initiated discovery processes.

Much of the current contentiousness between the 'instructivists' and 'constructivists' however, is about the extent to which formal academic instruction may be appropriate or necessary for those young children whose early environments do not provide sufficient experiences for spontaneous informal learning of basic things like the alphabet, the names of colors and shapes, etc. However, as indicated below, longitudinal studies comparing "instructivist" and "constructivist" approaches suggest that the early gains of children in the 'instructivist' preschool curricula do not last more than a year or two.

Intellectual goals and activities

While academic goals address small units of knowledge and skills, intellectual goals address dispositions, i.e. habits of mind that include a variety of tendencies to interpret experience (Katz, 1993). The intellectual dispositions include the disposition to make sense of experience, as noted in the example of the child's understanding of lambs liking to "march." The dispositions to theorize, analyze, hypothesize, and synthesize, to

predict and to check predictions, to find things out, to strive for accuracy, to be empirical, to grasp the consequences of actions, to persist in seeking problem solutions, and to theorize about cause-effect relationships, to predict others' wishes and feelings, and many others are all intellectual rather than academic in focus.

It is reasonable to assume that the most important intellectual dispositions are in-born in all humans and are likely to be fairly robust in very young children - though, as in almost all human characteristic, the strength of these dispositions vary from one individual to another. For example, the dispositions to make sense of experience, to be curious, and to be empirical, can be observed in virtually all very young children, regardless of family income and environment. Indeed, one of the hazards of living and working with toddlers is that their powerful in-born dispositions to be empirical could lead to their self-destruction if their supervision is not sufficiently vigilant!

The risks of neglecting the intellectual dispositions

While the manifestation of some intellectual dispositions is likely to be provoked and supported in both academic and non-academic curriculum models, they deserve explicit attention in the curriculum planning and teaching methods

for several reasons outlined below. In other words, to capitalize on and to strengthen these in-born intellectual dispositions, early childhood curriculum and methods must provide contexts in which they can be manifested, appreciated, and thereby further developed.

Mindless activities in early childhood classes

As suggested above, one of the major issues in the constant wrangling over curriculum goals, methods, and now standards or outcomes, is that just because young children are not offered the formal academic instruction characteristic of the 'instructivist' position does not necessarily mean that their intellectual dispositions are sufficiently addressed. In many non-academic early childhood programs children spend much time on relatively mindless activities like cutting and pasting pre-cut Valentine hearts, and in group discussions about favorite pets from which the majority of the participants withdraw psychologically within minutes. While such activities are not advocated by the 'constructivists,' providers of such programs may believe that they are appropriate and beneficial because they Some rationalize these activities on the basis of their being 'fun.' While such activities do no harm and may be beneficial in a few ways, they lack sufficient intellectual vitality to support or strengthen the intellectual dispositions.

Recovery of lost dispositions.

As suggested earlier, it seems reasonable to assume that the major intellectual dispositions are in-born in all children. However, unless the curriculum provides contexts in which the intellectual dispositions can be behaved and strengthened by being used and applied meaningfully, they may be weakened or even lost. If they are lost they may be very difficult to reinstate. In other words, unless they are expressed and supported with sufficient frequency they may be weakened, and again, may be very resistant to re-learning. Long ago Margaret Donaldson (1978) noted that all children seem to begin their school experiences with eagerness to find things out and to pose questions, to do what is asked of them in school, and that "The problem then is to understand how something that begins so well can often end so badly" (p. 14).

The damaged disposition hypothesis

Observation of children in a wide variety of academically oriented programs confirms the fact that young children <u>can</u> engage in formal lessons and academic exercises designed to instruct them in basic skills such as phonics, counting, and handwriting, and often to do so quite willingly. But the extent to which they *should* do so must be evaluated in light of the potential cumulative effects that these exercises may have on the development and strengthening of

the dispositions to use the knowledge and skills. I am suggesting here that it is useful to distinguish between having reading skills and having the disposition to be a reader, and both of these goals must be addressed in selecting curriculum and teaching methods. In this sense, we are obliged to take into account the potential cumulative effects of early experiences, no matter how benign they appear to be at the time they occur, on long-term developmental outcomes.

I suggest that a strong academic 'instructivist' approach may undermine the disposition to use the very knowledge and skills so intensely instructed. Indeed, there is reason to believe that early instruction in and mastery of phonics or arithmetic may be obtained at the risk of undermining the dispositions to use the learnings. Note here again the useful distinction between having reading skills and having the disposition to be a reader. I am suggesting that the disposition to be readers or similarly, to be ready users of mathematical concepts and skills often painfully acquired, may be damaged by premature instruction, given the amount of drill and practice usually required for success in mastering these skills at an early age. This concern can be referred to as the *damaged disposition hypothesis* (Katz, 1985).

Longitudinal studies. The damaged disposition hypothesis seems to be a reasonable interpretation of the results of several longitudinal studies (Karnes et al., 1983; Marcon, 1993,. 1994; Miller & Bizzell, 1983;

Schweinhart et al., 1986a; see also Walberg, 1984; Consortium for Longitudinal Studies, 1983). As we look at the results of these studies, the early pressure on young children to perform academic tasks taught by direct instruction (e.g., practice in phonics, workbook exercises) appears quite harmless or even beneficial at first. Certainly many of the children *can* perform the tasks involved.

However, on the whole these studies suggest that while formal instructional teaching methods during the preschool and kindergarten years may appear to be beneficial in the *short term*, they show negative effects on academic, intellectual and social development in the *long term* (Schweinhart, 1997, Schweinhart and Weikart, 1997, Marcon, 1992, 1995). In particular, the long term follow-up studies of children in High/Scope's Perry Preschool Program, (see Schweinhart, 1997) and the follow-up studies of Marcon, (1995) indicate that in the long term children benefit greatly academically, intellectually, and socially from early childhood programs that provide opportunities for them to take initiative, and to be actively engaged in their own learning experiences. Marcon (1995) refers to the long-term negative effects of early formal direct instructional programs as the "Fourth Grade Slump." Marcon summarizes her findings as follows:

> "the negative impact of overly academic early childhood programs on achievement and social development was clearly apparent by the fourth grade. Children who had attended [Academically Directed] prekindergarten programs were scoring noticeably lower in fourth grade despite their adequate performance on third-grade standardized achievement tests. The [Academically directed] children were also developmentally behind their peers and displayed notably higher levels of maladaptive behavior (i.e. defiant behavior, anxiety, and distractibility) (Marcon, 1995, p. 19).

Furthermore, the 'constructivists' emphasis on young children's need to take an active role in their learning may be especially important in the case of boys. Marcon points out that

> In general, boys do not adjust as well as do girls to didactic early learning approaches. Boys show more stress behaviors in DIP [developmentally inappropriate practice] kindergartens. This is especially true for African American boys in lower socioeconomic status. Development and achievement of inner-city boys are fostered by kindergarten that emphasize socioemotional growth over academics and are hindered by overly academic, didactic kindergarten experiences. (Marcon, 1999, p. 359).

Results from these longitudinal studies support the position outlined earlier that curriculum design for young children should be approached in a way that optimizes the *simultaneous* acquisition of knowledge, skills, *and*

desirable dispositions. It is clearly not very useful to have skills if the dispositions to use them are undermined in the process of acquiring them. On the other hand, having the disposition without the skills is also inconsistent with the goals of education. The challenge, then, is to help the learner with both the acquisition of skills and with desirable dispositions that invoke the application of those skills.

In sum I am suggesting that an appropriate curriculum for young children is one that addresses both the acquisition of academic skills in such a way that the dispositions to use them are also strengthened. A robust disposition to be a reader can serve all of the intellectual goals of education throughout life. Experience of working with teachers who implement the "project approach" as part of their curriculum suggests that it offers opportunities for both important skills, the dispositions to use them, and intellectual development to be addressed (Katz & Chard, 1989).

The Process versus product dichotomy.

In is not unusual to hear early childhood (and other educators) value the processes in which children engage more than the products that result from them. This is another and related dichotomy in education that may prevent us from noting a third, or other position on the matter. I suggest that it is not very beneficial for children to engage in desirable processes, e.g. investigations, if they

are focused on poor, shallow or worthless content and if they lead to products of low standards. Similarly, it seems unwise, as well as unnecessary, to offer children rich content via inappropriate processes, regardless of the quality of the products. The same can be said of good products resulting from poor processes that also address poor or silly content. In other words, an appropriate curriculum for young children should address *with equal care*, the nature of the processes employed, the value of the content addressed, and the quality of the products (See the appendix describing a project that addresses process, content, and product effectively).

Curriculum components that support the development of intellectual dispositions

An appropriate curriculum thus includes ample opportunity for strengthening and using the dispositions, plus good processes about rich content, resulting in high quality products. For these reasons many of my colleagues and I have been helping teachers to incorporate project work into the curriculum (Katz & Chard, 1989, Katz, 1994; Beneke, 1998). Excellent examples of meaningful long term projects in which children's intellects as well as growing academic skills flourish can be seen in the work of the children in the preprimary schools in Reggio Emilia as for example, reported in the book Shoe and Meter, (Reggio Children, 1997), as well as in reports of projects like

Beneke's Rearview Mirror. Reflections on a Preschool Car Project. These are just two of many examples (See Helm, 1998) that show how young children can express their intellectual dispositions in the pursuit of serious topics, and apply their emerging and academic skills, and generate high quality products simultaneously.

Project work provides contexts not only for the intellectual dispositions involved in the investigations that children undertake; it also provides texts and pretexts for children to make meaningful and functional use of the academic skills they are taught during the 'instructive' part of the curriculum. Thus we might "trichotomize" the early childhood curriculum so that it is focused on at least a trio of goals: (1) social/emotional and (2) intellectual development and (3) the acquisition of meaningful academic skills.

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Appendix

All About Balls

A Preschool Project

The project approach to the early childhood education is one that incorporates project work as one part of the larger curriculum. A project is an in-depth extended investigation of a topic - ideally one worthy of the children's time and energy. Project work is usually conducted in three phases. The first phase includes exploring and sharing the experiences, ideas, and information the participating children already have related to the topic, and closes with agreement on what research questions will be addressed by the investigation. The second phase is a period of data gathering, first-hand observations of phenomena related to the topic, interviewing experts, and other information gathering strategies, depending on the ages of the participants. The final phase includes a debriefing concerning what has been found out, bringing the investigation to a conclusion, and preparing reports to be shared within the class as well as with other classes, parents, and others in the community who might be interested in the children's findings.

The summary below of a project conducted by a group of young children is an example of how a teacher was able to incorporate project work in her class even though for various reasons she was unable to take her class outside of the school. Some time was spent on it on most days of the week over a period of about a month.

Phase 1

The teacher began by suggesting to her group of four- and five-year olds that they ask their families, relatives, neighbors and friends to contribute any kind of old balls to a collection they were making in their preschool class for a study of balls.

Within a week the class had a collection of 36 balls of many different kinds. The collection included tennis, ping- pong, cricket, croquet, billiard, golf, and bowling balls, as well as volleyballs, basket balls, a soccer ball, baseballs, a football, a beach ball, whiffle ball, and some marbles. One child added a world globe to the collection as well.

As the collection grew, the teacher encouraged discussion about how the balls varied. In the course of the discussion she developed a topical web indicating the many features of the balls in the class collection that could be studied in detail. However, there was some hesitation among the older children in the group about whether the globe was a ball or not.

The issue of the globe led to a discussion about whether a ball was only something to be played with. This led the teacher to bring in some picture books showing the common uses of ball bearings in various simple machines and a discussion of balls serving as wheels on some kinds of chairs. In the course of one of these discussions the teacher introduced the concept of *sphere* and the term *spherical* that many of the children enjoyed discussing and arguing about. The term *circumference* was also introduced into the discussion and recalled by some of the children. The question of whether the (American) football was a ball or not also became a focal point for heated debate.

Phase 2

Small groups of children volunteered to undertake specific investigations to answer the questions generated by the class in discussion with their teacher and indicated on the topic web.

Before the small group investigations were launched, the children made predictions of the outcomes. For example, one group weighed the balls and checked their predictions concerning which of them would be the heaviest and lightest. Their predictions indicated their strong association of size and weight, and their empirical findings yielded further curiosity and discussion. They were not quite ready to grasp the complexity of the concept of density!

One group of children, working in pairs, used string and struggled to measure the size of each of the balls by cutting the string to the length of the circumference. It invariably required several attempts before successful measurement was achieved. Students then displayed the strings by hanging them vertically in serial order on a chart displayed on a bulletin board.

Another small group used blocks and a plank to create inclined planes of various angles down which some of the balls were rolled. At first the children studied which balls would roll the fastest and farthest down the plank and along the floor. Then they conducted the same procedure on the linoleum floor, a carpet, on grass, and on gravel surfaces outside their classroom to observe the differences in the distance of free roll once down the plank. In the course of this exploration and discussion with their teacher the children enjoyed applying the terms *rough and smooth surfaces* to describe the slowing down of the balls' roll caused by grass and gravel compared to the linoleum and carpet surfaces.

A group of the younger children made rubbings of the surface of each ball. That activity led to a discussion of the variations of surface texture in the collection for the rest of their class. All were surprised at the wide variety of surfaces in their collection.

Another small group created a block structure several feet in height and, using a tape measure suspended from the top of it, predicted and then measured as best they could the height of the bounce of each ball. Contrary to their predictions, and much to their surprise, not all of them bounced!

The teacher engaged the children in a discussion of what might be inside each of the balls, in the course of which she explored with them the terms *hollow, solid, empty,* and *full.* With the exception of the golf ball, all of the balls were opened and their contents examined. The children were unable to open the bowling ball in the class and succeeded in getting it opened with the assistance of a parent volunteer.

Following the close examination of the properties of the balls in the collection, the children discussed the variety of ways in which balls are used in games. They discussed which balls are struck by bats, clubs, mallets, and racquets, and which balls are caught, thrown, and moved by hands and feet. They also surveyed their parents on which games they played, and which games they enjoyed watching.

Phase 3

In the course of work that lasted about a month, the children engaged in measuring, drawing, reading and creating stories, looking things up in the local library with the help of the librarian and many parents, examining books about sports, and reporting to parents the story of their investigation and their findings.

Many parts of the investigation presented difficulties. For example, getting the strings around balls to measure the circumference and ascertaining the height of their bounce required considerable skill and persistence, both of which were strengthened by the work undertaken. As the children participated in preparing displays of their

findings they asked the teacher to write words that they could copy onto their drawings and charts

This project also provided contexts for analyzing, hypothesizing, predicting, observing, recording and representing research findings. It also provided a setting for extensive discussions, cooperation, individual initiative, and sharing responsibilities, and many other developing intellectual as well as social capacities and dispositions. Children of all cultures and language backgrounds can become deeply engaged in the kinds of intellectual explorations such items in their own environments can provide.

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